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ABSTRACT

This document is a summary of one of two presentations about collaborative projects between scientists and science educators. Each paper offers insights into accomplishments and obstacles encountered during the respective programs. Paper summaries include: (1) "Academy for Excellence in Science and Mathematics Education"; (2) "Bemidji State University"; (3) "The Collaborative Vision for Science and Mathematics Education at Michigan State University"; (4) "Do It For Yourself First"; (5) "Fort Hayes State University: Improving Teacher Preparation through the General Education Science and Mathematics Curriculum"; (6) "Greater Wichita Area Mathematics and Science Education (GWAMSE) Collaborative"; (7) "Kalamazoo College Science Education Collaborative"; and (8) "Teagle Project: Reforming Math and Science Teacher Education." (WRM)

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STRAND A: SCIENCE AND SCIENCE EDUCATION COLLABORATIVES: WHERE WE ARE, HOW WE GOT THERE, AND WHERE WE ARE GOING

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Abstract

This symposium is one of two connected presentations about collaborative projects between scientists and science educators. Participants will highlight obstacles faced and how obstacles are addressed.

Summaries of Collaboratives

This document is a collection of brief descriptions of operating collaboratives and offers insights to accomplishments and obstacles at each of those institutions.

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The second of the two connected sessions is Session Saturday - 4.6 Science Education and Science Faculty Collaboration: Developing a Common Philosophy of Science Teaching and it takes place from 2:20 - 3:20 p.m in Airship. This second session will include survey data from NARST and AETS members who are involved in science educator/scientist collaboratives. Perspectives and documentation of philosophical teaching issues will be presented.

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D. Duggan-Haas

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Academy for Excellence in Science and Mathematics Education

Department of Science and Mathematics Education

Oregon State University

Goals of Collaborative

- Improvement of K-16 Science and Mathematics Education
- Improvement of K-16 Science and Mathematics Teacher Education
- Development of collaborative campus-wide efforts among scientists, mathematicians, science educators, and mathematics educators
- Active research program on teaching and learning in science and mathematics
- Procure external funding for the support of excellence in science and mathematics education

Participants

Scientists, Mathematicians, Science Educators, Mathematics Educators, and Engineers across campus - Core Advisory Board consists of Chairs from appropriate academic units

Catalysts for collaboration

- Recent concerns for the quality of science/mathematics education at K-16 levels both at the national and state levels
- Oregon State University mission to contribute to the enhancement of science and mathematics teacher education at all levels throughout the state
- Oregon State University recognition as state leader in science and engineering
- Oregon State University recognition as lead state institution in science and mathematics education

Funding sources

- College of Science General Fund
- National Science Foundation
- U.S. Department of Education
- Oregon Department of Education

Obstacles to collaboration

- Differing perspectives on knowledge base for teaching and learning
- Departmental release time
- History

Accomplishments

We have been able to secure external funds from both NSF and the Department of Education for professional development projects spanning grades 6-college. The NSF grant is a five year grant that will enhance teachers' subject matter knowledge, knowledge of inquiry and nature of science, and ability to teach scientific inquiry and nature of science. The DOE grant will enable us to completely revise the undergraduate biology course sequence for non-majors in a way that

makes them more consistent with national reforms. In addition, this project has the potential to influence the knowledge and practice of future teachers at the K-16 levels. Finally, we have been involved in staff development workshops related to scientific inquiry throughout the state.

What We Wish We Knew Before Starting:
The amount of organization skills and interpersonal communication turns out to be far more than we expected. We did know that such matters would be of significant importance, but there has been much more "ego massaging" than we had envisioned.

Bemidji State University

Institute Description:

Small State Institution with a long history of Teacher Preparation

Begun:

Fall 1995

Goals of the Collaborative:

To foster a cooperative relationship between the Professional Education Department and the Various Science Departments in the development of the K- 12 Teacher Education program at BSU.

University Participants:

Approximately 10 University Faculty (out of 22) from the Professional Education Department and 15 University Faculty from the Departments of Biology, Physics, Chemistry, Geology, and Mathematics.

Outside Participants:

K- 12 teachers, School Administrators, and Staff from the Minnesota Department of Children, Family, and Learning.

Funding Sources:

SciMath-MN
Eisenhower Professional Development Program

Important Accomplishments:

Continued regular meetings and a significant increase in cooperation of Faculty from Professional Education and Science Departments at Bemidji State University.

A new Teacher Licensure program in Science Education for grades K – 8 and grades 9 -12 at Bemidji State University to take effect Fall 2000. This new licensure program was developed with the cooperation of the Departments of Professional Education, Physics, Chemistry, and Earth Science.

Development of the Summer Science Institute Program and a complete revision of the M.S. degree program in Science Education at BSU.

The Collaborative Vision for Science & Mathematics Education at Michigan State University

Goals of Collaborative

- Creating new images of what science and mathematics education might be
- Providing a forum for consideration of needs and priorities for work in science and math education, i.e., strategic planning
- Informing our faculty better of one another's work and of relevant developments at the national, state, regional and local levels
- Facilitating preparation of collaborative projects that interrelate multiple aspects of our work
- Communicating the scope and impact of our combined efforts to administrators and policy makers
- Focusing of institutional support for major proposals
- Providing an access point for queries, expressions of concern or proposals about science and math education
- Providing a more informed, timely, and effective voice on policy matters that arise
- Fostering an intellectual community for faculty and advanced graduate students

Participants and/or leaders

Participants number more than forty and include staff members from the Michigan Department of Education as well as the MSU Colleges of Education and Natural Science. Ed Smith of the College of Education led the writing of the original proposal and continues to facilitate the group. A steering committee including mathematics, science and technology educators from the two colleges has met regularly, with active participation and support from the Division of Science and Mathematics Education of the College of Natural Science. The Graduate Assistant supported by the College of Education grant has been an important part of the leadership.

Catalysts for collaboration

In 1997 Dean of the College of Education, Carole Ames, requested internal proposals to foster intellectual communities through the creation of "theme" groups. The College of Education science education faculty convened a meeting with mathematics educators. The outcome was a proposal for a science and mathematics education "theme" group that emphasized collaboration between the Colleges of Education and Natural Science. Tim Smith had laid groundwork for CVSME by establishing the Science Education Brown Bag Lunch Group. This group of scientists and science educators met approximately once a month for two years prior to the formation of CVSME to discuss a wide range of issues relating to science teaching and learning. It continues to meet today.

Funding sources

CVSME is supported by a small ($8000/year) internal grant from the College of Education Dean's Office. Several externally funded projects have emerged in which CVSME has played a key role. This includes a Howard Hughes Medical Institute grant of over one million dollars and several smaller grants.

Obstacles to collaboration

- The greatest obstacle faced is time.

- Defending common positions rather than seeking common ground.
- Failure to value others' expertise.
- Competition with non-collaborative activities.
- Lack of professional rewards for collaboration.

Nature of support for collaborative
CVSME is supported fiscally by both the Dean's office in the College of Education and Division of Science and Mathematics Education (DSME) in the College of Natural Science. The Director of DSME has played an integral role in CVSME. This continues through a change in a change of leadership. Many faculty have made invaluable individual commitments, serving on the steering committee and coordinating other meetings. The GA has also played an integral role.

Accomplishments
- Improved communications of ongoing projects.
- Howard Hughes Medical Institute grant of $1.6 million to improve undergraduate biology teaching.
- Development of DSME Educational Principles <http://www.dsme.msu.edu/challenges.htm>
- Two NASA funded NOVA grants.
- A new science course for future elementary teachers.
- A substantial and growing website that offers a central location for information sharing related to science and mathematics teaching and learning from pre-school through graduate school.
- A listserv with approximately fifty subscribers where information relevant to science and mathematics education is shared within the university community. The listserv also provides a vehicle for the dissemination of an electronic newsletter, The CVSME Update. The newsletter is also archived on the website.
- CVSME sponsored colloquia related to the teaching and learning of science and mathematics that have been well attended by faculty from both the College of Education and the College of Natural Science.

What We Wish We Knew Before Starting:
- Improved communication is a great accomplishment.
- Community building takes time, and can be frustrating. Expect to, "work through the chaos" [Peck, 1998 #156].
- Establish priorities and work to have agreement between collaborative organizers and those who are being organized.
- Diplomacy is essential.
- Keep things practical.

Contact information and URL:
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Mark Olson, CVSME Graduate Assistant Olsonma7@msu.edu
The CVSME website: http://ed-web3.educ.msu.edu/cvsme

Do It For Yourself First

School of Education and Physics Department

DePaul University

Chicago, IL.

Goals of collaboration:

- To develop a common philosophy of science teaching
- To develop common content themes for both science courses and science education courses.
- To learn about teaching by analyzing our own teaching.

Participants:

Jerry Foster (Associate Professor, elementary science education)
gfoster@condor.depaul.edu
Elizabeth Roettger (Associate Director of Space Science Center for Education & Outreach, NASA/DePaul; also Physics Dept.)
eroettge@condor.depaul.edu
Lynn Narasimhan (Associate Dean, College of Liberal Arts & Sciences; Director of Space Science Center).
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Catalysts for collaboration:

- An associate dean is leading the development of an *Interdisciplinary Science Center* and related courses.
- We have *common interests*: we want elementary education majors and other non-science majors to develop a positive attitude towards science.
- We share the perception that *each of us needs the expertise and insight of the others.* Also, we seem to be developing deeper insights in unexpected directions.

Funding Sources and Nature of Support:

- None at this point.
- Support is based upon our own interest to develop a collaborative infrastructure.

Obstacles to collaboration

- Lack of knowledge about each other's expertise.
- Time and different schedules
- Perceived differences about each other's knowledge base for teaching and learning.

Accomplishments:
We have an ongoing dialogue that has been invaluable to both of us in terms of understanding our own teaching, science, and learning. We believe this benefits the students within our classes in both Colleges. We have been having conversations that are needed between scientists and science educators. We have made at least minor changes in our teaching. We are finding a common philosophy of science teaching.

Nature of collaboration:
2-3 people meet for discussion semi-regularly. We make trial runs of ideas & small projects, discuss current issues (such as changing degree requirements), share resources, and are trying to develop infrastructure and strategies for future programs and systemic changes.

What we wish we knew before starting

- Knowledge for developing a common language, trust, the habit of collaboration, and the infrastructure (to avoid or reduce barriers) in order to make various projects work.
- If we want other to collaborative we must first do it for ourselves.
- Funding sources are not necessary to developing long term and meaningful collaborative structures.

Fort Hays State University

Improving Teacher Preparation through the General Education Science and Mathematics Curriculum

Goals of Collaborative

- Modify existing mathematics and science content courses to utilize the learning cycle model of instruction to serve as a model of teaching and learning for preservice elementary teachers
- Infuse technology throughout these courses from the WWW to the use of calculator and microcomputer based laboratories
- Connect the experiences as a referent for teaching in the science and mathematics methods course for elementary teachers

Participants and Leaders

Paul Adams, Physics
Germaine Taggart, Teacher Education
Linda Kallam, Mathematics (now at Southeastern Oklahoma State University)
James Hohman, Chemistry
Ervin Eltze, Mathematics
Target Audience: Preservice Elementary Teachers

Catalysts for Collaboration

- The participants in the project recognized that preservice teachers view science and mathematics content as a collection of facts and felt it was time for a change
- Action research documenting the impact of the classroom innovations has proved to be an important aspect of the participants continuing with the project

Funding Sources

National Aeronautic and Space Administration, Project NOVA, through subcontract with the University of Alabama, Tuscaloosa

Obstacles to Collaboration

- Shortage of time to work in a collaborative fashion
- Students preconceived notion of what science and mathematics teaching and learning should be (i.e. just tell me what I need to know)
- Internal pressure to "cover" a set amount of material each semester

Nature of Support for Collaborative

- Reassigned time for key faculty
- Financial support from the university to purchase technology items
- Departments permitting faculty to try modified sections of the courses

Contact Information

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WWW: http://www.physics.fhsu.edu/~nova

GWAMSE Collaborative

Mission Statement:

The Greater Wichita Area Mathematics and Science Education Collaborative (GWAMSE Collaborative) was formed for the purpose of improving the mathematics, science and technology skills of our present and future citizens by enriching the preparation and professional development of science and mathematics teachers in grades K-16.

Goals:
In an effort to accomplish this mission, the collaborative will:

- Be comprised of representatives of the professional community who see mathematics, science and technology skills as high priority.
- Establish a representative baseline for the existing level of these skills.
- Build and use a quality team approach.
- Create a communication network among the stakeholders: Businesses, universities, schools, teachers, parents, and students.
- Facilitate change for developing excellence in mathematics, science and technology education for diverse student populations at all levels, K-16
- Perpetuate a community of life-long learners.

Participants:
University faculty from science, mathematics, and curriculum and instruction departments; representatives from businesses; award-winning science and mathematics teachers; school district mathematics and science curriculum specialists; director of the Fairmount Center for Science and Mathematics; and a representative from Exploration Place

Catalysts for collaboration:
Faculty from the teacher preparation program felt the need to collaborate with the content faculty for the improvement in the preparation of science and mathematics teachers.

Funding sources:
(1) Initial finding came from three campus sources, the Dean of the College of Education, the Dean of the College of Liberal Arts and Sciences and the Academic Vice- President. (2) The members of the collaborative then wrote and received funding for a two-year Eisenhower grant to carry out part of its mission. (3) Boeing Airplane Corporation has provided money for lending kits, graduate assistants, and a planning grant.

Obstacles to collaboration:
Mostly lack of time to be involved. Lack of commitment from some of the content areas.

Accomplishments:
Through project STAMPEDE, we were able to financially support both content and pedagogy faculty to work with teachers in the summer and during the academic year.

Contact information:
Catherine Yeotis yeotis@twsu.edu

URL:
http://web.physics.twsu.edu/gwamse/gwamse.htm

Kalamazoo College Science Education Collaborative

Goals of Collaborative

- To prepare our graduates to teach science well and to become life-long learners about learning, whether they enter K-12 education or pursue advanced degrees in science.
- To further develop science-specific education opportunities for future 7-12 teachers, graduate teaching assistants and college and university faculty.

Participants

Don Duggan-Haas, Education Department
Paul Olexia, Director, Division of Natural Science and Biology Department
Anne Dueweke, The Academic Resource Center

Catalysts for collaboration

- In the fall of 1999, Don Duggan-Haas was hired as the institution's first science educator in at least three decades. Don had worked in collaborative efforts between scientists and science educators before coming to Kalamazoo College and pursued further such collaboratives upon his arrival.
- The institution has a single methods course for all secondary subject areas.
- The Supplemental Instruction (SI) Program, is an established valuable resource at Kalamazoo College involving juniors and seniors and peer instructors for "high risk" classes – typically first year science courses. SI Leaders are paid minimum wage for a high stress campus job. Our collaboration is investigating the possibility of SI Leaders receiving course credit instead of payment. This would entail more than the current program requires. A proposal for an accompanying seminar is being developed.

Funding sources

So far, meetings have been cost free. If the collaboration results in a course offering, faculty schedules would be re-aligned without outside funding.

Obstacles to collaboration

We have only just begun, so we have not yet met considerable obstacles beyond the time demands required for developing new courses, and we have not really even gotten to that point as yet.

Nature of support for collaborative

Support has generally been affective. This comes in the form of mutual respect and a willingness (even eagerness) to work together to improve science education.

Accomplishments

We are talking!

Contact information and URL if appropriate

Don Duggan-Haas, dhaas@kzoo.edu

Teagle Project: Reforming Math and Science Teacher Education

Edgewood College

Goals of Collaborative

- To create new levels of interaction and alignment among Edgewood's Education, Natural Science and Mathematics & Computer Science Departments.
- To develop inquiry-based instructional strategies in our math and science courses
- To integrate the learning of science and math with how to effectively teach science and math in elementary, middle and secondary school classrooms
- To Integrate the content of our science and math classes
- To develop working relationships between our pre-service teachers and teachers actively teaching in K-12 classrooms

Participants and/or Leaders

Members of the Education, Natural Science and Mathematics & Computer Science Departments as well as classroom teachers in our partnership schools. Francie Rowe of the Natural Science Department led the writing of the Teagle Proposal and currently chairs the SMEI Committee (Science Math Education Initiative) which oversees the activities of the project.

Catalysts for collaboration

In January 1999 Edgewood's Natural Science Department moved into a new facility, Sonderegger Science Center, a joint project of the College and its sister institutions, Edgewood High School and Edgewood Campus Grade School. The move consolidated the Natural Science Department (prior to the move spread out across the campus) and opened the door for collaboration between the three institutions.

A second catalyst for collaboration came from the recognition that the *National Science Education Standards* and the *Benchmarks* along with the *Wisconsin's Model Academic Standards* were changing the expectations of instruction for institutions of higher education preparing students for the teaching professions. Edgewood saw a need to change its teacher education programs in math and science to better prepare its graduates to teach in K-12 classrooms.

Funding sources

The Teagle Foundation, New York, NY has funded the Edgewood reform effort with a three year grant of $348,000.

Obstacles to collaboration

- Bringing all three departments to an agreement on the goals of the reform
- Not enough time
- A lack of understanding of the disciplines, workings and goals of "foreign" departments

Nature of support for collaborative

The Teagle Project has received support from the Academic Dean, Judith Wimmer, and the College President, James Ebbed. In addition to the College administration, the Chairs of all three departments have supported the teacher education reform effort.

Accomplishments

- Improved communication between the three departments
- Development of a new science course for elementary education majors that will include a shadow methods course
- The introduction of inquiry based teaching strategies to science department faculty
- The identification of K-12 partner schools
- Collaboration with the University of Wisconsin-Madison Office of Space Science
- Scholarship funding for Edgewood students pursuing careers in science education

What We Wish We Knew Before Starting

The amount of time spent in meetings and navigating the landscape of interdepartmental turf would be great, far more than expected.

Contact information and URL if appropriate

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Ken Jewell, Mathematics & Computer Science Department: jewell@edgewood.edu